Original Research JCAM

Effect of preemptive epidural analgesia in percutaneous nephrolithotomy

Perkütan nefrolitotomide preemptif epidural analjezinin etkisi

Preemptive epidural analgesia

Gulsen Ozkan Tanrıverdi[1], Elzem Sen[2], Suleyman Ganidagli[2]
[1]Department of Anesthesiology, 25 Aralik State Hospital,
[2]Department of Anesthesiology and Reanimation, Gaziantep University, Gaziantep, Turkey

Öz

Amaç: Bu çalışmada Perkütan Nefrolitotomi (PNL) olacak hastalarda , genel anestezinin ve genel anesteziye eklenmiş epidural anestezinin stres yanıtı, hemodinamik değişimler ve postoperatif analjezik gereksinimlerinin karşılaştırılması amaçlanmıştır. Gereç ve Yöntem: PNL yapılan 50 hasta vardı. Hastalar randomize olarak 2 gruba dağıtıldı. Grup A: Genel anestezi verilen (sevofluran + 50% O2+ air mixture + 2 µg/kg fentanil) (n=25). Grup E: Epidural analjezi. Gruplar arasında demografik veriler, hemodinamik parametreler, postoperatif VAS değerleri ve analjezik tüketimleri karşılaştırıldı. Bulgular: Bu çalışmada cerrahi strese nöroendokrin yanıtın değerlendirilmesi için kullanılan parametrelerden glukoz, insülin, kortizol ve C-reaktif protein değerlerindeki değişimler her iki grupta istatistiksel olarak benzerdi (p> 0.05). Gruplar arasında postoperatif toplam analjezik tüketiminde istatistiksel olarak anlamlı fark yoktu (p> 0.05). Tartışma: Stres ve inflamatuvar yanıttaki değişiklikler tek doz epidural analjezi etkinliğinin sürdüğü dönemde önlenir, ancak sonraki dönemlerde etkisiz kalmaktadır.

Anahtar Kelimeler

Preemptif Analjezi; Hemodinamik; Stres Yanıtı; PNL

Abstract

Aim: The present study aimed to compare stress response, hemodynamic changes, and postoperative analgesic requirements of general anesthesia and preemptive epidural analgesia added to general anesthesia in patients who will receive Percutaneous Nephrolithotomy (PNL). Material and Method: There were 50 patients undergoing PNL. Patients were randomly distributed into two groups: Group A: General anesthesia (GA) group (induction; sevoflurane + 50% O2+ air mixture + 2 µg/kg fentanyl) (n=25). Group E: Epidural analgesia (13 mL 0.25% levobupivacaine + 2 mL 100 µg fentanyl) + GA (induction; sevoflurane + 50% O2+ air mixture + 2 µg/kg fentanyl) (n=25). Demographic data, hemodynamic parameters, postoperative VAS values and analgesic consumption were compared among the groups. Results: The changes in glucose, insulin, cortisol, and C-reactive protein from the parameters used in the present study to assess the neuroendocrine response to surgical stress were statistically similar in both groups (p>0.05). There was no statistically significant difference in the postoperative total analgesic consumption between the groups (p>0.05). Discussion: The changes in stress and inflammatory response are prevented in the period during which the efficacy of single-dose epidural analgesia continues; however, it remains ineffective in the following periods.

Keywords

Preemptive Analgesia; Hemodynamic; Stress Response;. PNL

DOI: 10.4328/JCAM.5246 Received: 27.07.2017 Accepted: 29.07.2017 Printed: 01.11.2017 J Clin Anal Med 2017;8(6): 501-6

Corresponding Author: Elzem SEN, Department of Anesthesiology and Reanimation, University of Gaziantep, School of Medicine, 27310 Gaziantep, Turkey.
GSM: +905327842151 F.: +90 3423603998 E-Mail: drelzem@hotmail.com

Introduction

Stress response refers to the whole series of autonomic, neuroendocrine, metabolic, and immune responses to achieve homeostasis of the body against stimulations started by various harmful stimuli [1]. Percutaneous nephrolithotomy (PNL) is an endoscopic procedure performed under general anesthesia or epidural anesthesia [2]. Preemptive analgesia has been reported to affect stress response by preventing the first painful stimulus in the neural system during a surgical procedure [3,4]. The present study aimed to compare stress response, hemodynamic changes, and postoperative analgesic requirements of general anesthesia and preemptive epidural analgesia added to general anesthesia in patients who will receive PNL.

Material and Method

The present study was planned after obtaining the approval of the local ethics committee dated 28.04.2008 and with decision no: 04-2008/94. All the patients were informed about the study, and informed consent form was obtained from them.

The study included 50 patients aged between 18 and 70 years, who were American Anesthesiologists Association (ASA) risk group I-II and would receive PNL by the Urology Department between April and September 2008 at Gaziantep University Hospital. Patients were randomly distributed into two groups:

Group A: General anesthesia group (induction; sevoflurane + 50% O2+ air mixture + 2 μg/kg fentanyl) (n=25)

Group E: Epidural analgesia (13 mL 0.25% levobupivacaine + 2 mL 100 μg fentanyl) + general anesthesia (induction; sevoflurane + 50% O2+ air mixture + 2 μg/kg fentanyl) (n=25)

Patients with a body mass index >30 kg/m2; local anesthesia or opioid allergy; ongoing use of opioids; active infections; neurological diseases; abnormal coagulation tests; cardiac, hepatic and renal failure; endocrine-metabolic disorders; patients who were uncooperative; and patients who had no ability to physically or verbally perform and compare were excluded from the study. Considering the diurnal rhythm of cortisol, attention was paid to operate patients between 08:00 and 10:00 a.m.

One day before the surgery, patients were given detailed and understandable information about the study, and their written consents were obtained.

Fifteen minutes before taking patients into the operating room, a preoperative blood sample was taken for glucose, cortisol, insulin, and CRP analysis in both groups. Blood samples were repeated 30 minutes after the incision and at postoperative hours 1 and 24.

Initial hemodynamic parameters and age, height, weight, gender, and ASA risk groups were recorded.

Before anesthesia, Group E was administered infiltration anesthesia with cutaneous and subcutaneous 20 mg 2% lidocaine (Jetmonal ampul® Adeka) at the level of the L1-L2 intervertebral space, after ensuring asepsis of the lumbar region. From the same space, a 15G Tuohy epidural needle (Portex®, Epidural minipack, Mexico) was advanced in such a manner that the opening would be in a cephalic direction using a midline approach and epidural was determined using the loss of resistance technique. After it was ensured that there was no blood or cerebrospinal fluid, a test dose of 3 ml 2% lidocaine was administered. Then, 13 mL 0.25% levobupivacaine (Chirocaine flakon® Abbott, USA) + 2 ml 100 μg fentanyl (Fentanyl®, Abbott, Chicago) was administered slowly as a total of 15 ml volume bolus.

Preoxygenation was administered to patients for three minutes, and during the induction, 1-2 mg/kg propofol (Propofol® 1%, Fresenius Kabi, Hamburg) and 2 μg/kg fentanyl (Fentanyl®, Abbott, Chicago) were administered. Following the loss of the eyelash reflex, muscle relaxation was ensured using IV vecuronium bromide (Norcuron®, Organon, Holland, 0.1 mg/kg). For maintenance, sevoflurane (Sevorane® Abbott, USA) was used at a 2-2.5% concentration within 5 l/min of 50% O2 - 50% air mixture. Patients were set to the prone position.

Hemodynamic parameters of all patients were recorded after 2 and 5 minutes following intubation. Again, all these changes were monitored and recorded after 2, 5, 10, 15, 30, 45, 60, 90, and 120 minutes following skin incision.

Hemodynamic parameters were recorded at postoperative hours 1, 2, 4, 8, 16, and 24. Pain severity was evaluated using VAS (0=no pain, 10= worst possible pain) at postoperative hours 1, 2, 4, 8, 16, and 24. In the postoperative period, IV tramadol PCA (Contramal, Abdi İbrahim) was administered in both groups for pain management at 4 ng/ml concentration with a bolus dose of 20 mg, maintenance dose of 8 mg/hour and lockout time of 20 minutes.

Statistical Analyses

To evaluate the study results, the statistical analyses were performed using SPSS (Statistical Package for Social Sciences) for Windows 15.0 program. Parametric data were analyzed using the student t-test, and non-parametric data were analyzed using the x2 test. Intragroup comparisons were analyzed using the paired samples t-test. P<0.05 was considered statistically significant. The data were expressed in mean ± standard deviation (mean ± SD).

Results

The patients' gender, age, weight, height, and ASA risk groups were evaluated. The groups were similar regarding the duration of operation and anesthesia (p>0.05) (Table 1).

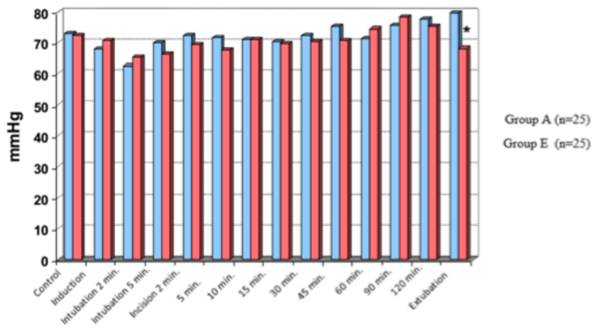
Table 1. Patient demographics data

	GROUP A (n=25)	GROUP E (n=25)	P
Gender (F / M)	11 / 14	11 / 14	100
Age (years)	40.00 ± 13.26	36.84 ± 12.29	0.754
Weight (kg)	72.48 ± 16.50	74.12 ± 14.78	0.876
Height (cm)	166.80 ± 0.08	167.44 ± 0.07	0.464
Duration of anesthesia (min)	88.44 ± 30.14	76.32 ± 25.67	0.163
Duration of operation (min)	72.60 ± 28.94	66.60 ± 26.00	0.277
ASA I / II	12 / 13 (24%)	13 / 12 (26%)	100

The MBP values measured during extubation were significantly lower in Group E compared to Group A (p<0.05). There was no change in groups' MBP values compared to control values (p>0.05) (Figure 1).

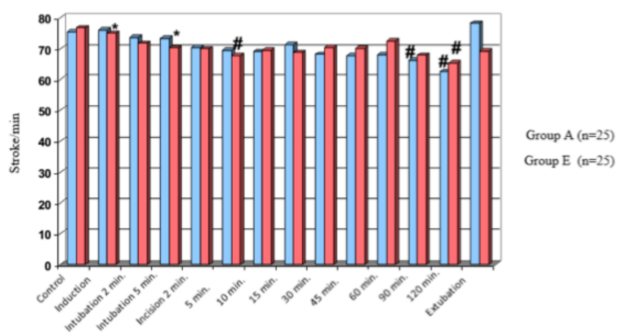
Among the hemodynamic parameters measured, the heart ratio values were statistically significantly lower in Group E compared to Group A at post-induction and-intubation minute

5 (p<0.05). The intragroup assessment revealed significant reductions in heart rate at minutes 90 and 120 in Group A, and at minutes 5 and 120 in Group E compared to control values (p<0.05) (Figure 2).



*(p<0.05) Statistically significant difference in the inter-group comparison

Figure 1. MBP variation between groups over time



*(p<0.05) Statistically significant differences in the inter-group comparison
#(p<0.05) Significant differences compared to control value in the intragroup comparison

Figure 2. HR variation over time in all groups

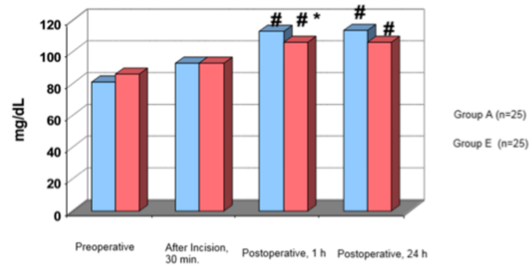
The control means of glucose, insulin, cortisol, and CRP from the parameters used in the present study to assess the neuroendocrine response to surgical stress were statistically similar in both groups (p>0.05).

The blood glucose levels of Group E were statistically significantly lower at postoperative hour 1 compared to Group A (p<0.05). The intragroup comparison revealed significant elevations at postoperative hours 1 and 24 in both groups compared to the control value (p<0.05) (Figure 3).

The inter-group comparisons revealed statistically significantly lower blood levels of insulin in Group E at postoperative hour 1 compared to Group A (p<0.05). There were significant elevations in insulin levels at postoperative hour 24 in both groups compared to the control values (p<0.05) (Figure 4).

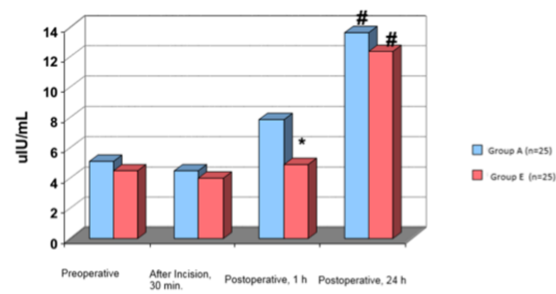
There was no statistically significant difference in measured cortisol values between the groups (p>0.05). The intragroup comparison revealed a significant elevation at postoperative hour 1 in Group A, and post-incision minute 30 and postoperative hour 24 in Group E compared to control value (p<0.05) (Figure 5).

There was no statistically significant difference in CRP between the groups at any measurement point (p>0.05). The intragroup comparison revealed a statistically significant elevation at postoperative hour 24 in both groups compared to the control value (p<0.05) (Figure 6).



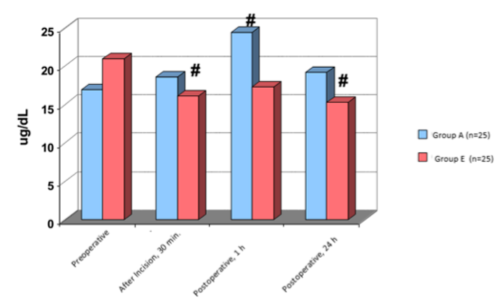
*(p<0.05) Statistically significant difference in the inter-group comparison
#(p<0.05) Statistically significant differences compared to the control value in the intragroup comparison

Figure 3. Glucose variation between groups over time



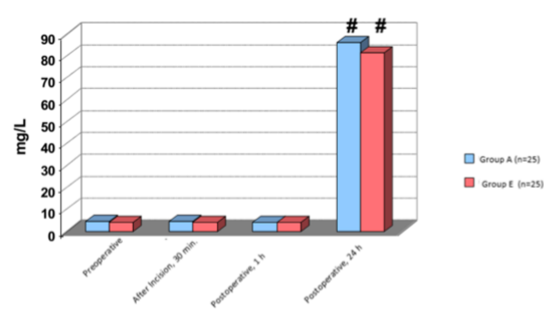
*(p<0.05) Statistically significant difference in the inter-group comparison
#(p<0.05) Statistically significant differences compared to the control value in the

Figure 4. Insulin variation over time by groups



#(p<0.05) Statistically significant differences compared to the control value in the intragroup comparison

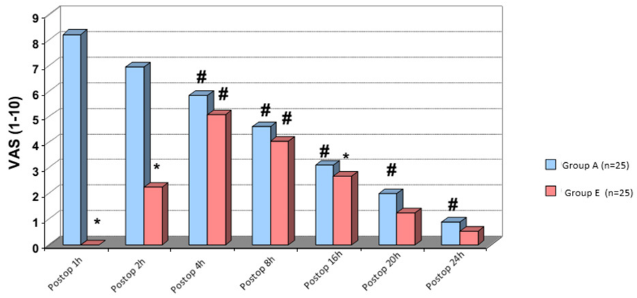
Figure 5. Cortisol variation over time in groups



#(p<0.05) Significant differences compared to the control value in the intragroup comparison

Figure 6. CRP variation over time in groups

The inter-group comparison of pain scores in the postoperative period revealed statistically significantly higher VAS levels at hours 1, 2, and 16 in Group A compared to Group E (p<0.05). There was no significant difference between the groups at other measurement points (p>0.05). Based on the intragroup comparison, the VAS levels at postoperative hours 4 and 8 were significantly higher compared to postoperative hour 1 in Group E (p<0.05). In Group A, the VAS levels measured at postoperative hours 4, 8, 16, 20, and 24 were statistically significantly decreased compared to postoperative hour 1 (p<0.05) (Figure 7). There was no statistically significant difference in the postoperative total analgesic consumption between the groups (p>0.05) (Figure 8).



*(p<0.05) Statistically significant differences in the inter-group comparison
#(p<0.05) Significant differences compared to the control value in the intragroup comparison

Figure 7. VAS variation over time in groups

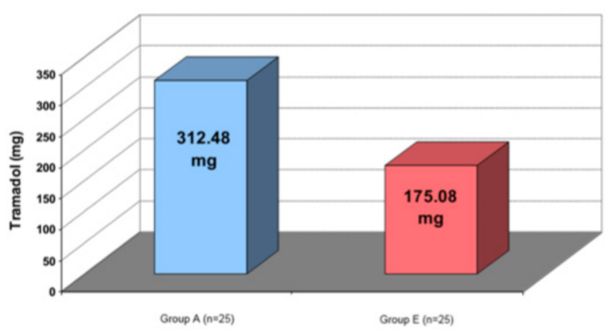


Figure 8. Postoperative 24-hour analgesic consumption amount of the groups

Discussion

Percutaneous surgery has superseded open surgery procedures owing to the advantages of lower cost, lower morbidity, and shorter recovery times. Since PNL, different from open surgery, is performed in the prone position and also suitable at the surgical level, it can be performed using epidural anesthesia. General anesthesia is most commonly preferred in such patients [5]. In general anesthesia, hemodynamic responses vary by anesthetic depth. The combination of general anesthesia with regional methods may change these responses. Cox et al. [6] conducted a study with 88 patients and indicated that hypotension was the most common side effect reported during the surgery in 18 patients that received bupivacaine after administering 0.5% 15 ml (75 mg) bupivacaine, 0.5% 15 ml (75 mg) levobupivacaine, or 0.75% 15 ml (112.5 mg) levobupivacaine through the epidural route, and there was no evident difference in the effects on the cardiovascular system between the groups. The present study also revealed that hemodynamic parameters are suppressed with general anesthesia + epidural analgesia (0.25%) levobupivacaine.

Preemptive analgesia studies suggest that the co-administration of local anesthetics, opioids, and other agents would provide prolonged analgesia and suppress the inflammatory response, and therefore it may be more effective in reducing pain intensity [7].

Dahl et al. [8] reported that preoperatively administered epidural bupivacaine and morphine did not produce different results than postoperatively administered epidural bupivacaine and morphine. In order to recommend preemptive analgesia clinically, it is important to establish the timing, duration, and optimal density of analgesia that would prevent changes in dorsal horn neurons after tissue injury through experimental studies. The findings of the present study also indicate that preemptive epidural analgesia does not affect postoperative analgesic consumption statistically.

Dahl and Kehlet [9] claimed that central sensitization does not occur only in the preoperative period, but may also be induced in the postoperative period due to permanent infection and hyperalgesia in the wound site. Therefore, we planned analgesic treatment as pre-, intra-, and postoperative in the present study.

It is difficult to determine analgesic requirement, administer small doses when required, and notice undesired effects during single-dose analgesic application in postoperative analgesia [10]. Therefore, we preferred the PCA method. We used a synthetic opioid (tramadol) with intravenous PCA for postoperative pain management in the groups.

Hyperglycemia occurs after the inhibition of the hepatic glycogenolytic response, which develops as a response to surgical stress. It has been reported that glucose homeostasis is better maintained with epidural analgesia in lower abdominal operations [11]. The increased plasma glucose level related to surgery starts just after the initiation of surgery. Regarding this, reduced glucose use by peripheral tissues due to surgery is an important factor, as well as increased glucose production by cortisol and catecholamine [12].

Loughran et al. [13] compared general anesthesia and epidural anesthesia in patients undergoing cesarean sections, and established that the epidural block reaching at least the T6 dermatome suppresses blood pressure, heart ratio, and plasma levels of catecholamine, cortisol, and glucose.

Lattermann et al. [14] found that glucose response is more limited in patients receiving epidural anesthesia compared to the general anesthesia administered group. Lattermann et al. [15] in another study investigating the anti-catabolic effect of neuro-axial blockage following hip surgery did not establish any difference in glucose production rates on postoperative day 1 in both groups receiving general anesthesia and combined spinal-epidural anesthesia.

The lower plasma glucose level observed in the present study in Group E at postoperative hour 1 is consistent with other studies. A glucose level >150 mg/dl was not observed in any of the groups.

Blood glucose levels are known to be lower with a postoperative epidural opioid application compared to the intravenous opioid application [6]. Again, compared to postoperative intravenous morphine application following general anesthesia, it has been that observed blood glucose levels are better suppressed by paravertebral anesthesia and analgesia combined with general anesthesia [16]. In the present study, tramadol, which is an intravenous synthetic opioid, was administered with PCA to both groups in order to ensure inter-group standardization. Therefore, we believe that there was no significant difference between the groups.

Prior studies established that cortisol levels increase starting from the skin incision in cases that received general anesthesia + epidural analgesia, but the blood cortisol levels were suppressed in the general anesthesia +epidural analgesia group compared to the general anesthesia -administered group [17,18].

Kouraklis et al. [19] established that there was a lower elevation in cortisol and glucose levels in the combined general and epidural anesthesia group having upper abdominal surgery compared to general anesthesia, but it was not completely suppressed.

Norman et al. [20] reported that the effect of epidural analgesia on stress response to surgery is not as significant. Another study showed that this kind of application does not produce any difference in plasma cortisol levels between groups [21].

The present study did not establish any statistically significant difference between the groups. Cortisol levels were higher at postoperative hour 1 compared to the control value in Group A, while cortisol levels were significantly lower at post-incision minute 30 and postoperative hour 24 compared to the control value in Group E. Single-dose epidural anesthesia and analgesia planned for the present study allowed to observe the change in the surgical stress profile through the elimination of analgesic efficacy in the same patient group. Ultimately, it was concluded that epidural analgesia better suppresses the stress response.

Asoh et al. [22] study compared epidural anesthesia and general anesthesia in terms of plasma concentrations of glucose, lactate, non-esterified fatty acids, and insulin, indicated that the glucose level is significantly lower in epidural anesthesia group, the insulin/glucose rate is lower at postoperative day 1 in epidural anesthesia group, and that the insulin sensitivity is better. They concluded that epidural anesthesia is likely to inhibit endocrine, metabolic response in upper abdominal surgeries.

Schricker et al. [23] study compared combined epidural and general anesthesia with general anesthesia in patients undergoing colorectal surgery and found that intraoperative lactate, free fatty acids, insulin, and glucagon did not change in either group, but the concentrations of cortisol and glucose increased ($p<0.05$). They concluded that both types of anesthesia were insufficient to prevent the intraoperative reduction in glucose use. Insulin, an anabolic and hypoglycemic hormone, decreases after trauma, in contrast to glucose and cortisol. This helps to maintain hyperglycemia and preserve the metabolic state in vital organs [24].

The present study observed reduced insulin levels in Group E in the measurements at postoperative hour 1. We believe that the efficacy of preemptive epidural analgesia continued at this measurement point.

Plasma levels of some proteins increase in acute inflammatory settings or secondary to various tissue injuries. Postoperative plasma levels of CRP indicate the severity of the acute phase response to surgical trauma. Elevations in CRP levels may vary from an amount as slight as 50% to an amount as great as 1000-fold. CRP starts to increase at 12 hours following trauma and inflammation, reaches the maximum level at 48-72 hours, and returns to normal levels after one week [25].

In the present study, intravenous tramadol PCA was used for postoperative pain management in both groups. VAS scoring was lower within the first two hours in Group E compared to Group A ($p<0.05$). We believe that this resulted from the continued effect of analgesia within the first postoperative two hours in the group that received preemptive epidural analgesia preoperatively.

In conclusion, preemptive epidural analgesia combined with general anesthesia was suppressed hemodynamic parameters slightly compared to the only general anesthesia group. The groups were similar in terms of side effect profiles. It was concluded that the changes in stress and inflammatory response are prevented in the period during which the efficacy of single-dose epidural analgesia continues; however, it remains ineffective in the following periods.

Financial Disclosure

The authors declare that this study has received no financial support.

Conflict of Interest

No conflict of interest was declared by the authors.

Human and animal rights statement

Authors undersign the certificate that the procedures and the experiments we have done respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2000, as well as the national law.

References

1. Kehlet H, Holte K. Effect of postoperative analgesia on surgical outcome. Br J Anaesth. 2001; 87: 62-72.
2. Preminger GM, Clayman RV, Curry T, Redman HC, Peters PC. Outpatient percutaneous nephrostolithotomy. J Urol. 1986; 136: 355.
3. Vincent JC. Mechanisms of pain and control. Principles of Anaesthesiology. Vol. 2 pp:1317-1349. Lea and Febiger, Pennsylvania. USA. 1993.
4. Mc Ovay HJ, Carrol D, Moore RA. Postoperative orthopedic pain-the effect of opiate premedication and local anesthetic blocks. Pain. 1988; 33: 291-5.
5. Manomar T, Prashant J, Mahesh D. Supine percutaneous nephrolithotomy: Effective approach to high-risk and morbidly obese patients. J Endourol. 2007; 21: 44-9.
6. Cox CR, Faccenda KA, Gilhooly C, Bannister J, Scott NB, Morrison LM. Extradural S(-) bupivacaine: comparison with racemic RS- bupivacaine. Br J Anaesth. 1998; 80: 289-93.
7. Kavanagh BP, Katz J, Sandler AN, Nierenberg H, Roger S, Boylan JF. Multimodal analgesia before thoracic surgery does not reduce postoperative pain. Br J Anaesth. 1994; 73: 184-9.
8. Dahl JB, Hansen BL, Hyortso NC. Influence of timing on the effect of continuous extradural analgesia with bupivacaine and morphine after major abdominal surgery. Br J Anaesth. 1992; 69(1): 37-40.
9. Dahl JB, Kehlet H. The value of preemptive analgesia in the treatment of postoperative pain. Br J Anaesth. 1993; 70: 434-9.
10. Wilmore DW. Catabolic illness: Strategies for enhancing recovery. N Engl J Med.1991; 325: 695-702.
11. Licker M, Suter PM, Krauert F, Rıfat NK. Metabolic response to lower abdominal surgery analgesia by epidural blockade compared with intravenous opiate infusion. Eur J Anaesth. 1994; 11: 193-9.
12. Desborough JP. The stress response trauma and surgery. Br J Anaesth. 2000; 85: 109-17.
13. Loughran PG, Moore J, Dundee JW. Maternal stress response associated with caesarean delivery under general and epidural anaesthesia. Br J Obstet Gynaecol. 1986; 93(9): 943-9.
14. Lattermann R, Carli F, Wykes L, Schricker T. Epidural Blockade Modifies Perioperative Glucose Production without Affecting Protein Catabolism. Anesthesiology. 2002; 97: 374-81.
15. Lattermann R, Belohlavek G, Wittmann S, Fuchtmeier B, Gruber M. The anticatabolic effect of neuraxial blockade after hip surgery. Anesth Analg. 2005; 101(4): 1202-8.
16. Salomaki TE, Leppahuoto J, Laitinen JO, Vuolteenaho O, Nuutinen DS. Epidural versus intravenous fentanyl for reducing hormonal, metabolic and physiologic responses after thoracotomy. Anesthesiology. 1993; 79: 672-9.
17. Tanaka K, Harada T, Dan K. Low dose TEA induces discrete thoracic anesthesia without reduction in cardiac output. Regional Anesthesia. 1991; 16: 318-21.

18. Hase K, Meguro K. Perioperative stres response in elderly patients for elective gastrectomy the comparison between isoflurane anesthesia and sevoflurane anesthesia both combined with epidural anaesthesia. Masui. 2000; 49: 121-9.
19. Kouraklis G, Glinavou A, Raftopoulos L, Alevisou V, Lagos G, Karatzas G. Epidural analgesia attenuates the systemic stress response to upper abdominal surgery: a randomized trial. Int Surg. 2000; 85: 353-7.
20. Norman JG, Fink GW. The effects of epidural anesthesia on the neuroendocrine response to major surgical stress: A randomized prospective trial. Am Surgeon. 1997; 63: 75-80.
21. Breslow MJ, Parker SD, Frank SM, Norris EJ, Yates H, Raff H, et al. Determinants of catecholamine and cortisol responses to lower extremity revascularization. Anesthesiology. 1993; 79: 1202-9.
22. Asoh T, Tsuji H, Shirasaka C, Takeuchi Y. Effect of epidural analgesia on metabolic response to major upper abdominal surgery. Acta Anaesthesiol Scand. 1983; 27(3): 233-7.
23. Schricker T, Galeone M, Wykes L, Carli F. Effect of desflurane/remifentanil anesthesia on glucose metabolism during surgery: a comparison with desflurane/epidural anesthesia. Acta Anaesthesiol Scand. 2004; 48(2): 169-73.
24. Christensen NJ, Hilsted J, Hegedüs L, Madsbad S. Effects of surgical stress and insulin on cardiovascular function and norepinephrine kinetics. Am J Physiol. 1984; 247: 29-34.
25. Roumen RMH, van Meurs PA, Kuypers HHC, Kraak WAG, Saverwein RW. Serum interleukin-6 and C-reactive protein responses in patients after laparoscopic or conventional cholecystectomy. Eur J Surg. 1992; 158: 541-4.

How to cite this article:
Tanrıverdi GO, Sen E, Ganidagli S. Effect of Preemptive Epidural Analgesia in Percutaneous Nephrolithotomy. J Clin Anal Med 2017;8(6): 501-6.